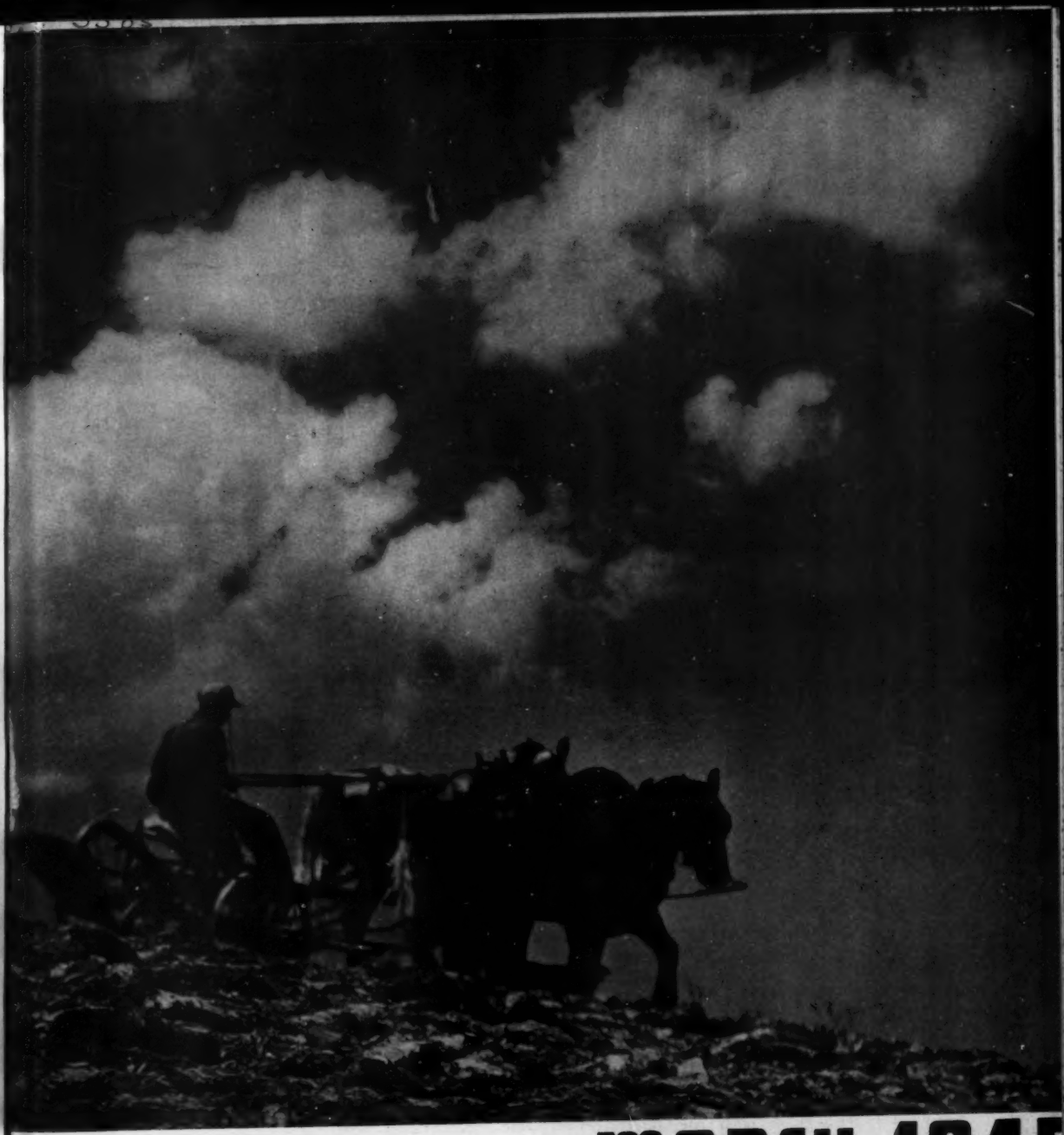

MARCH 1945

SOIL CONSERVATION

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SOIL CONSERVATION

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ISSUED MONTHLY BY SOIL CONSERVATION SERVICE, U. S. DEPT. OF AGRICULTURE, WASHINGTON, D. C.

VOL. X—No. 9 MARCH • 1945

WELLINGTON BRINK EDITOR

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Front Cover: Plowing strip in April on the Wagner Farm. Lancaster County, Pa. Photographer: George Lowary.

SOIL CONSERVATION is *issued monthly by* SOIL CONSERVATION SERVICE of the United States Department of Agriculture, Washington, D. C. The matter contained herein is published by direction of the Secretary of Agriculture as administrative information required for proper transaction of the public business, with the approval of the Director of the Budget. SOIL CONSERVATION seeks to supply to workers of the Department of Agriculture engaged in soil conservation activities, information of special help to them in the performance of their duties. Copies may be obtained from the Superintendent of Documents, Government Printing Office, Washington 25, D. C., 10 cents a copy, or by subscription at the rate of $1.00 per year, domestic; $1.50 per year, foreign. Postage stamps, will not be accepted in payment.

"CINCHING UP" for the NEXT ROUGH RIDE

By H. J. HELM

Range areas of the Northern Great Plains, in general, now have an abundance of forage. This is far different from the dreary period of 1934 through 1936, when many ranchers had to dispose of almost all of their livestock. Then there were many who feared the grasslands had been almost irreparably damaged.

Better management—some of it admittedly the direct result of heavy livestock sales, which reduced the numbers of animals on the range—helped start recovery. This, together with the abundant and timely rainfall of the last four years, brought the range lands back with a bang.

In other words, grasslands were given a chance to "get on their feet" before the war, and conservative stocking and ample rainfall put them in shape to absorb the one-two punches of record production.

Now, with the grasslands in productive condition, the job is to handle them so they will stay that way. Notwithstanding the abnormal times, characterized by mounting demands for food production and by shortage of labor, much progress has been made toward this end. Interest in better range management has intensified the technicians' job rather than simplified it.

EDITOR'S NOTE.—The author is chief, range division, Soil Conservation Service, Lincoln, Neb.

Hay stacks in reserve. These are as necessary to good range management as well-grassed pastures. They are a buffer against severe winters or dry spells. With a good feed reserve, the rancher can weather emergencies without having to abuse his grasslands.

Crested wheatgrass on formerly cultivated land which had been abandoned for cropping. Small sagebrush and weeds had taken over the land when the grass was seeded, but crested wheatgrass now has gained almost complete ascendancy over competing vegetation. This field, left for seed last year, is capable of producing a lot of meat and wool.

Improvement in range management is profitable, sometimes spectacularly so. For example, the returns from moderate stocking on the Central Plains Experimental Range in Northeastern Colorado have been estimated at $742 per section, compared with $724 per section from heavy stocking.

Definite management plans already have been worked out for one-fourth of the nearly 54 million acres of pasture and range land in soil conservation districts in the Northern Great Plains, and on the 20-odd million acres included within land utilization projects, which are land-use demonstrations. Some of these plans are now fully in effect. Development of the newer ones has now started. More and more ranchers are working out similar plans with the help of the Soil Conservation Service technicians assisting the districts.

To date, adjustment in stocking the pastures has been accomplished on nearly half of the land in soil conservation districts for which conservation plans have been made, and on nearly all the land utilization projects. It is also progressing on other areas for which plans have been made.

Conservation marks the attitude of many ranchers, A group of eastern Montana ranchers declined to increase stocking rates on federally-owned lands in one project, because "we have good grass now, we intend to keep it good, and we might need the reserve grass for emergencies should a severe winter or drought come along." This, from ranchers whose production now is several times what it was a few years ago.

Range management includes many things in addition to harmonizing livestock numbers and feed reserves. It includes putting watering places where they can help management, rotation grazing to use grasses when they produce most, various devices to keep moisture on the land to boost grass production, and water-spreading on the more nearly level lands. Adequate water supplies located at the right places have proved to be probably the greatest single factor facilitating practical range management. More than six thousand watering places have been developed, eleven hundred of them being wells and spring developments and the rest dams. A little more than half are in land utilization projects.

Ward Stanley at Hot Springs, S. D., a cooperator with the Fall River Soil Conservation District, offers a typical demonstration of the significance of watering places in range management. He has 1,000 acres of range which he can use for but a few days at a time, after rains, because it is too far from any established watering place. He plans to build a dam there.

"The dams already built have resulted in better distribution of grazing," Stanley said, "and have helped to control the movement of stock. This distribution of stock undoubtedly brings a larger yield from the grass. In the drier years the dams will do much to help maintain production and keep the range in shape by distributing grazing. During such years I have seen the grass grazed to the ground near water, while farther away would be good, tall grass that wasn't touched."

Ranchers estimate that good distribution of water may increase the amount of feed available to stock by 10 to 25 percent. Apply the lower estimate to the 12½ million acres in soil conservation districts for which plans have been made, and the dams alone are making possible the maintenance of 50 thousand more cows and steers on the same acreage and without additional production of grass in the Northern Great Plains soil conservation districts.

Contour furrows or pitting of some pastures, and water spreading on others, help to produce more feed. Furrows have been built on 23 thousand acres of range lands included in the Northern Great Plains soil conservation districts, and water-spreading systems have been developed on some 16 thousand acres. Both of these practices are designed to make greatest use of moisture from snow or rain, but their application is limited by both soil types and types of rainfall.

The experience of A. M. Kester near Buffalo, Wyo., gives an indication of what these practices can mean in terms of pasture yields. He spread runoff from adjoining land across part of his 480-acre pasture and built contour furrows on the rest. Kester said that last year this pasture supported 52 animal units—a cow and a calf, or their equivalent, per unit—throughout the seven-month grazing season from May 1 to December 8. This is a little more than 9 acres per animal unit, which is about one-third of the acreage of range land ordinarily required.

Hugh Errington near Goodland, Kan., a cooperator with the Sherman County Soil Conservation District, first contour-furrowed part of his grama-buffalo grass pasture in 1937, then "grooved" part of it. ("Grooves" are very narrow furrows.)

"There is a lot more grass—the grass just gets bigger for a stretch 3 or 4 feet from the grooves," Errington said.

The furrows and grooving increase forage production even in good years such as 1944, Errington explained, fully 25 percent.

And remember, this practice is only beginning to be appreciated and its proper place determined.

Properly located watering places are extremely important to the range. They help to bring about proper distribution of livestock, resulting in uniform utilization of forage instead of severe overgrazing.

Water-spreading, for the most part, is being devoted to haylands. There, the additional water is being used both to increase yields of native hay and to make possible the raising of improved mixtures of tame grasses and legumes.

Fred Hesse near Buffalo, Wyo., spreads spring and summer runoff across 400 acres of hayland. His feed production improved appreciably, and he has reserve feed.

"It once was difficult to winter 1800 head of sheep," Hesse remarked, "but now I could winter 5000 head. I also have been able to store up a good quantity of reserve feed."

Hesse reports that his conservation ranching, together with careful management and culling of his sheep, as resulted in more than 50 percent increase in meat production and 75 percent increase in wood production. This is partly because he has a few more ewes, partly because better feed and water have helped to reduce the death loss from 12 to 2 percent, and partly because better feed and water have raised the average weight of lambs from 60 to 70 pounds.

Nearly all of the rotation grazing in the Northern Great Plains has resulted from the rehabilitation of abandoned cultivated lands, although a few ranchers are beginning to cross-fence lands so that they can rotate the use of pastures. This feature of range management, ordinarily the last to be put into practice, is just about as important as the provision of necessary watering places; actually, the watering places are needed to make rotation grazing practical.

In rehabilitating abandoned, cultivated lands, more than 371 thousand acres of privately-owned lands in the Northern Great Plains soil conservation districts now have been seeded to grass, mostly crested wheatgrass. In the land utilization projects more than 463 thousand acres have been seeded, practically all to crested wheatgrass. There are still 11 million acres of farm land that ought to be reseeded.

Since crested wheatgrass is ready for use well before the better known native grass, with the exception of western wheatgrass, and has a very high grazing capacity during the early months of the year, ranchers are seeing the benefits of using it in the spring months and deferring use of the native grasses until they have made good growth. In the fall, after rains, it resumes growth following a hot-weather dormant period.

Seeding crested wheatgrass, and as yet to a lesser extent bromegrass, Russian wild rye, and a few others, therefore, serves several useful purposes. It helps to bring land back into production, increases the ability of the native range lands to produce, reduces the winter feeding period, facilitates early spring calving or lambing, and furnishes hay for winter and reserve feed.

The experience of ranchers generally is that crested wheatgrass during its best grazing period, from around April 1 to approximately June 15, has a grazing capacity up to 3 or 4 times that of native grasses. The average capacity is conservatively estimated at not more than 1½ acres per month per cow. Thus, the rehabilitated land can furnish a month's feed for about 650 thousand cows.

P. A. Beveridge, near Redstone, Mont., a cooperator with the Reserve Soil Conservation District, reports that his spring losses have been much less since he has had crested wheatgrass pasture for calving. Walter Risen, near Malta, Mont., a cooperator with the North Phillip Grazing Association, says that his ewes on crested wheatgrass pasture at lambing time take care of twin lambs without trouble. The start his lambs get before

Water-spreading has increased greatly the grazing capacity of this native range land. Extra water is provided by diverting flood flow from a stream.

they go to summer pasture results in larger lambs than he used to have at market time.

George Tillman, also near Malta, another cooperator with the North Phillips Grazing District, commented particularly on the saving in feed. By starting growth about three weeks earlier than the naitve grasses in that area, crested wheatgrass makes an appreciable difference in feeding costs and labor. The normal winter feeding period is about 100 days, and three weeks knocked off that results in quite a saving.

George McFarland, near Rapid City, S. D., a cooperator with the Elm Creek Soil Conservation District, is one of the livestock growers who has cross-fenced his land to control grazing. He has learned that in average years this pays dividends in the form of greater grass production. The grass grows better when it is given rest periods.

Probably not strictly a part of range management, but having a pronounced effect on it, are the measures to increase the production of feed for winter use and to accumulate reserves for use during dry periods. Winter feed production is necessary even in areas where wintering of livestock on grasslands is common, and is even more important elsewhere. When feed supplies are available to meet emergency demands, it is unnecessary to abuse grasslands and thus upset the range management schedule.

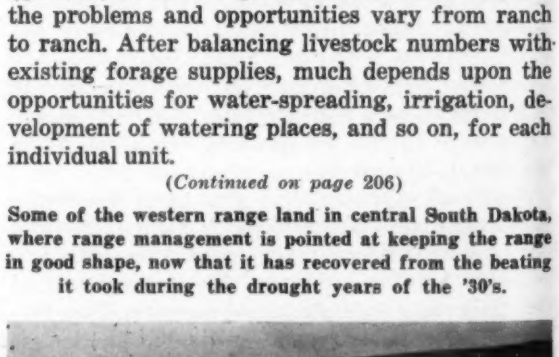
Water spreading, mentioned previously, is something to be developed over a large part of the Northern Great Plains. Improvement in the irrigated haylands in the ranch country is only now getting under way. The greatest sources of feed reserves, however, must come through the production of dryland native hay. There the moisture supply is most uncertain from year to year and the ranchers are being encouraged to cut extra hay in the good periods and hold it in reserve for the dry periods.

Olaf Polson, north of Kemmerer, Wyo., a cooperator with the Cokeville-Hamsfork Soil Conservation District, is one rancher who learned that improved iirrigation practices plus seeding an alfalfa-tame grass mixture yields two tons of hay per acre compared with less than a ton per acre previously obtained from his irrigated native grasslands. He is in territory where dryland hay production is almost non-existent. Aided by district technicians, he is now rehabilitating a good share of his haylands in order to produce the feed needed to stabilize his operations.

All of these things go to make up range management, or have a pronounced effect on it, and the problems and opportunities vary from ranch to ranch. After balancing livestock numbers with existing forage supplies, much depends upon the opportunities for water-spreading, irrigation, development of watering places, and so on, for each individual unit.

(*Continued on page* 206)

Some of the western range land in central South Dakota, where range management is pointed at keeping the range in good shape, now that it has recovered from the beating it took during the drought years of the '30's.



An improved 2-row potato planter which can be used on slopes up to 20 per cent and requires only one man to operate.

This new type potato sprayer applies the spray from the ground level upward, as well as from above, making possible complete coverage of plants.

RECENT RESEARCH IMPROVES POTATO MACHINERY

By JOHN W. SLOSSER

Potato growing machinery that is more efficient wherever it is operated and that can also be used with ease on hillside fields where contouring, terracing and other cross-the-slope soil and moisture conservation practices are in effect, has been developed as a result of recent research conducted jointly by the Soil Conservation Service, the Maine Agricultural Experiment Station and the University of Maine. Up to now potato growers who have adopted soil conservation measures have sometimes experienced difficulty when using machinery intended for conventional farming methods, with rectangular fields laid out in straight rows.

Four types of heavy potato machinery have been the subject of research—the planter, the multiple-row sprayer, the tillage tools and the digger. It has been the aim of the research men to develop machinery which will not only do a better and more economical job, under all conditions of potato growing, but which will cost no more than the conventional machinery. In fact, in the case of the planter, the standard-type machine can be converted at a cost of $50, and the work done by a local blacksmith or mechanic. The new planter can be operated satisfactorily across slopes up to 20 percent, and requires only one man to operate instead of the two needed for the planter now in general use. Because all soil-working parts of the planter are controlled by the soil surface, depth or spacing control is automatic. Fertilizer and seed are distributed very accurately, and seed-piece burn is eliminated.

The improved potato digger in action on an 18 per cent slope.

The multiple-row sprayer has been redesigned to provide complete coverage of all parts of the plants in a single trip. The old-type sprayer frequently required two trips round the field, and even then did not always get the spray material on the stems and under parts. The improved cover-

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Editor's Note.—The author is project supervisor, Soil Conservation Service, Presque Isle, Maine.

age is accomplished by applying the spray from the ground level upward, as well as from above. The efficient coverage may save enough in spray material and labor cost in a single season to pay for the new-type sprayer boom, which is slightly more costly than the conventional boom. The sprayer also operates under a lower pressure than usual, with consequent less wear and tear on pump and equipment. So far it has been developed to handle five rows. A seven-row boom is anticipated.

The tillage tools and the digger have also been improved so as to work satisfactorily on the contour and across the slope. The standard-type digger has been rebuilt so that on a steep side slope or on soil conservation terraces the machine will operate parallel to the ground surface while the elevator operates in a horizontal plane. In that way the potatoes are delivered gently and undamaged at the rear of the digger. Leveling is easily controlled and other operations are automatic, so that the operator is relieved of having to make the important depth-control settings.

Those who have helped to develop this improved potato machinery believe that research and improvements in farm machinery of various types will speed the spread of soil conservation practices throughout the country by making them easy to apply, even under the difficult conditions sometimes encountered in specialized farming.

J. Phil Campbell

PASSING OF J. PHIL CAMPBELL

In the death of J. Phil Campbell, Assistant Chief, on December 11 at Athens, Ga., the Soil Conservation Service lost a valued worker, friend and counsellor.

Mr. Campbell had been working directly with the Service since 1935, largely with the soil conservation district movement and in relationships with other agencies.

Early in life Mr. Campbell dedicated his services to the improvement of rural life. He became a teacher at the age of 17 in a country school which was the first agricultural high school in the State of Georgia. Entering Farmers Cooperative Demonstration Work (forerunner of the present Extension Service) as state agent for South Carolina in 1907, he served successfully as regional supervisor of Farmers' Cooperative Demonstration Work for the southeastern States—the first position of the kind in the Nation, as State Agent and head of cooperative extension work between the Georgia State College of Agriculture and the United States Department of Agriculture from 1910 until 1915, and as Georgia's Director of Extension until 1934, when he was called to the Washington Office of the AAA. In the Agricultural Adjustment Administration he was in charge of planning programs for using land removed from production of cotton and tobacco, of landlord-tenant relationships under AAA contracts, and of cooperative program of Agricultural rehabilitation and WPA rural projects.

Mr. Campbell's work served to enrich rural life, and left lasting imprints on the entire soil conservation movement. —T. L. Gaston

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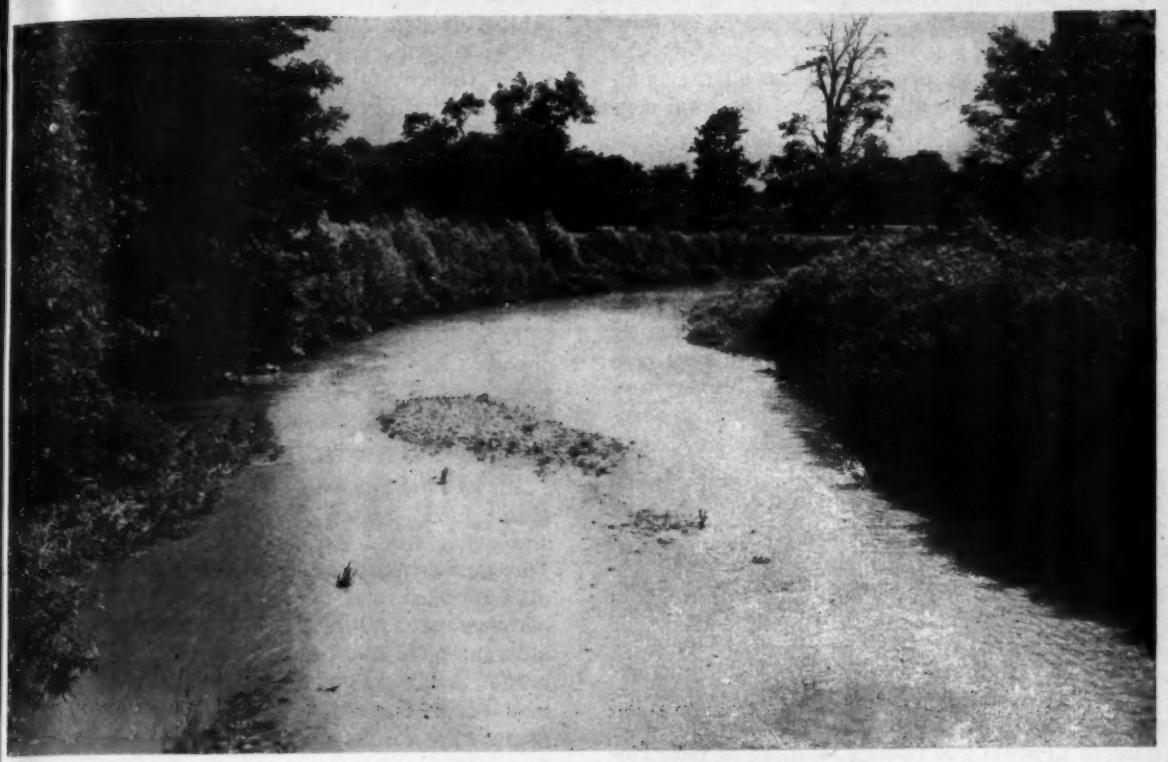
Our Canadian friends are expanding their work in soil conservation, as evidenced by the Conference on Conservation February 1 and 2, Kingston, Ont. This is the second conservation conference sponsored by the new Ontario Department of Planning and Development. Principal address was by Dr. Edward H. Graham, biology chief of Soil Conservation Service, "The Role of Living Things in the Care and Use of the Land."



FRONTIERS IN LAND USE BIOLOGY

By EDWARD H. GRAHAM

When accompanied by appropriate conservation measures on the watershed, streambank revegetation is a highly desirable erosion-control practice. More needs to be known of its biological values.

Farmers and ranchers throughout the Nation are applying soil and water conservation practices to cropland, range and pasture land, woodland, and land adapted best to the production of wild crops. They are doing this on more than 650 million acres of land in nearly 1200 soil conservation districts. In establishing such practices they are attempting to make use of all appropriate scientific and technical knowledge. Much of the knowledge that is proving useful is gleaned from studies and experiments not originally intended to solve specific land use problems. Hence, it is often fragmentary, partially adaptable to the practical problems at hand, or useful only as a result of patching together diverse and distantly related bits of information. In almost every phase of land management, there is a growing need for scientific information directed at the solution of particular land problems. This is especially true in the field of land-use biology.

As a result of research studies of the Soil Conservation Service, the State agricultural experiment stations, and other agencies, the erosion-control effectiveness of many conservation measures is already known. Thus, the soil-conserving values of strip cropping, terracing, cover crops, sub-surface tillage, stubble mulching and similar practices are fairly well understood. We also know that field-border plantings, hedges, pond management for fish, streambank revegetation, marsh management and other comparable measures not only are good for the land but profitable to the farmer. Numerous observations indicate that soil conservation measures increase wildlife. The effects of land-use practices upon populations are not yet fully understood, however. Much appropriate information has already been accumulated, and numerous useful studies are now under way, but it must be recognized that comparatively little research has yet been inaugurated in this important phase of land management. The best possible use is being made of the knowledge that is now

EDITOR'S NOTE.—The author is chief, biology division, Washington, D. C. This article is based upon material presented to the Ecological Society of America, September 1944.

available, but the more we learn about the biological aspects of soil and water conservation, the more effectively we are able to use all the facilities directed at the attainment of the total conservation job.

The biological work of the Soil Conservation Service is to assist farmers and ranchers in the application of sound land management practices. The work is part of an operations or actions program, and is based upon fundamental data obtained from the research of the Service and other Federal, State, and private sources. This article is presented in the hope that it may, in very general terms, suggest to colleges and universities, agricultural experiment stations, other governmental and private groups, agencies, and individuals, studies in the biological aspects of soil and water conservation and land use.

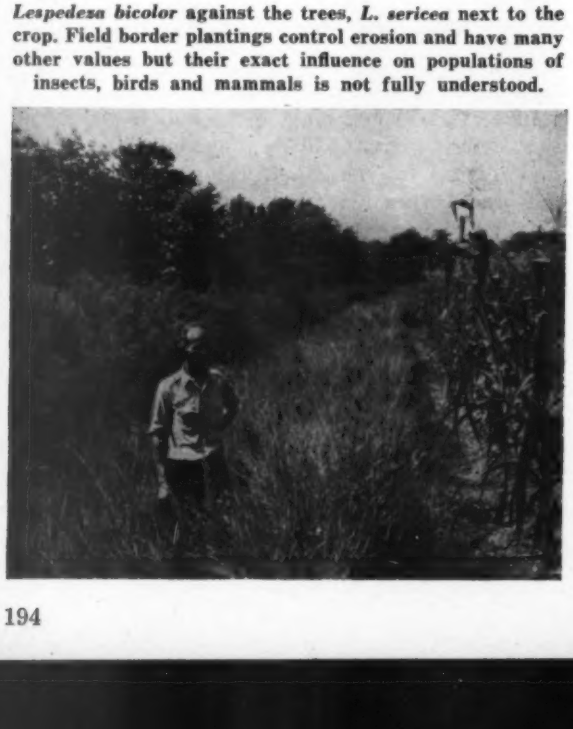
Management of farm ponds for fish production. Many applicable facts with respect to pond management have been learned, notably by the Alabama Agricultural Experiment Station, which recommends stocking a pond with 100 large-mouth black bass and 1500 bluegill bream fingerlings per surface acre and fertilizing the pond with commercial fertilizer. In the Southeast it is now possible to produce 250 pounds or more of palatable food fish annually per surface acre of pond—a meat yield comparable to that from our best pastures. Thousands of ponds are already producing fish—hundreds of thousands are likely to be stocked in the future. We still lack sufficient knowledge of the ecology of warm-water ponds, however, to determine satisfactory stocking rates, species of fish, and kinds of fertilizer for cold northern ponds and ponds of the western states, where waters are highly alkaline and pond water levels fluctuate greatly throughout the year.

Even in the Southeast, if the value of organic fertilizers (manure, hay, compost, offal, and seed meals) were better understood, and their use developed, it might be possible to reduce the cost of pond fish management and render it more readily accomplished on the average farm and ranch. Also, can trout waters be profitably fertilized? Only a handful of studies have been conducted on this subject. Management features are needed which render ponds, as well as sedimentation areas and settling basins above ponds, less suitable for mosquitoes, especially in malarial areas.

Marsh Management for muskrat production. Marsh land is often as productive, acre for acre and dollar for dollar, as any land on the farm. The coastal marshes of Louisiana yield up to 6 million muskrats per year, while the inland marshes of Minnesota yearly produce enough muskrat pelts to be worth between one and two million dollars. About two million acres of marshland—nearly one-third the total in the United States—are on farms and ranches, and it is believed that yields from these areas could be increased by specific land treatment. Although a great deal is known about marshes and muskrats, practical schemes for modifying marshlands to improve them as muskrat habitats have not been thoroughly explored. Further investigations are needed to throw additional light on such matters as (1) effects of ditching on muskrat populations; (2) methods of controlled burning in marshes, and their influence upon vegetation and muskrat numbers; (3) effects of various controlled water levels upon marsh vegetation; and (4) guides to rapid determination of muskrat numbers.

Streamside Ecology. During the past decade streambank erosion control by the use of vegetation has been accomplished in various places, particularly in the Northwest, Southwest, upper Mississippi Valley States, and the Northeast. We already know, that where it is supplemented with a watershed program for soil and water conservation, streambank control by vegetative means is a desirable practice on small streams. If we are to undertake any extensive program of restoring eroded streambanks to a protective cover of useful vegetation, however, additional facts should be at hand. If a grazed streambank is protected from livestock, what particular type of vegetation is likely to result along the stream in a given region or area? What are the common insects, birds, and

***Lespedeza bicolor* against the trees, *L. sericea* next to the crop. Field border plantings control erosion and have many other values but their exact influence on populations of insects, birds and mammals is not fully understood.**



Our knowledge of the effect of hedges on harmful and beneficial insects, birds and mammals is still inadequate. A contour hedge of *Rosa multiflora* does check soil loss and provide a living fence that turns livestock.

mammals which will inhabit such streamside vegetation? What plant species are best for controlling streambank erosion? What management measures will be required to maintain vegetation proved desirable for streambank control? These and other questions must be answered before vegetative means of streambank work can be guaranteed.

Streambank revegetation promises to assume the magnitude, in some states, at least, of community or public projects comparable in scope to the building, landscaping, and maintenance of public highways. An analysis of conservation needs conducted by the Soil Conservation Service shows nearly 1,000,000 acres of streambank erosion control to be necessary on farm and ranch lands. To make such projects more successful, it would seem, a great deal more needs to be known of the ecologic, as well as the hydrologic, behavior of streams and streamside habitats.

Hedge Management. The use of shrubs of low growth form for hedges, that will not spread into adjacent areas and that require little maintenance, promises to become widespread in some regions. As part of a national program of soil and water conservation on agricultural land, it is estimated that more than 500,000 miles of hedges are needed. Hedges are being established on the contour between crop and pasture fields, above vegetated diversion terraces, and to mark divisions between large fields. Although the values of hedge as an erosion-control and land-use measure are recognized, we still lack sufficient knowledge of the kinds and numbers of insects, birds, and mammals hedges support, particularly the relationship of these animals to crops grown in areas adjacent to hedges. Do hedges materially influence numbers of game birds and mammals, and if so, what game species can hedges be depended upon to benefit? Only a few studies have so far been conducted on this subject.

We also need experimental evidence to designate those species of plants that are most desirable for hedges grown under field (not garden) conditions, and which of them can be grown by seeding them on site, thus facilitating their establishment and obviating the cost of using nursery-grown stock. Recent experiments with Rosa multiflora have proved it to form a good living fence capable of turning livestock under field conditions. We need to know of other shrubs that can be substituted for fences when grown as hedges, and how to establish and maintain them with a minimum of care and expense.

Field Border Ecology. Throughout many of the eastern and southern states it is becoming a common erosion-control practice to establish shrubs on woodland margins, and, on the unproductive edges of crop field where they adjoin woodlots, to plant shrubs and other selected perennials, including a few introduced lespedezas (*L. sericea, L. bicolor, L. cyrtobotrya*). The establishment of useful vegetation on field borders, where erosion is often a serious problem, is frequently a necessary part of a complete farm plan. Some 50,000 acres of field border plantings have already been made by farmers, and it is estimated that 3,000,000 acres of such borders required the establishment of appropriate vegetative cover. There are questions yet unanswered about this practice, however. There are practical needs with respect to the use of the plants themselves—species most appropriate, best time and rate of seeding, selection of desirable strains—although many of these things are being learned through the experience of technicians and farmers who are using the plants. What is not being learned through practical experience is something of the ecology of these borders, which present a typical problem in "hedge effect." What is their influence upon animal populations? Are they of unqualified benefit to useful species (e.g. bobwhite, mourning dove, cottontails, bees), or do they materially increase undesirable species (e.g. cotton rat)? In brief, we require for field borders the same kind of knowledge needed about every particular land management device, practice, or measure being recommended for soil and water conservation and good land use—what is its biological effect?

Management of Spoilbanks. Where valuable coal deposits are near the surface, steam shovels

are often employed to expose them, the earth being overturned and laid aside. In many states, particularly throughout the Ohio Valley, strip-mined areas are a common sight. Numerous studies have been made of the plant succession that occurs on such areas, and plantings of various trees and shrubs have been made on them. It is estimated that there are approximately 250,000 acres of spoilbanks of various types in the United States needing some kind of treatment to make them once again productive land. But comparatively little attention has been directed to the determination of the most desirable types of revegetation to be undertaken on strip-mined areas, on ra wbanks of drainage and irrigation ditches, and on like sub-soil areas. Ecological facts, based upon a knowledge of biotic communities that succeed each other on such sites, might well suggest the best types of plantings consistent with the natural development of vegetation upon them. Should they be reforested, converted to pasture, or only protected from fire and grazing in order to permit natural revegetation for whatever wildlife and recreational areas they will in time provide?

Insect Problems. Damage to crops from injurious insects in the United States is known to amount to three billion dollars yearly. Whether this damage is likely to be increased or decreased by the adoption of land-use practices intended to control erosion is not yet fully known. There is a great deal of ecological work necessary to provide land managers with the entomological knowledge they need in order to successfully establish and maintain soil conservation practices. In brief, the question usually is: Will the adoption of a given practice, applied to control soil erosion, result in a change of insect populations, and if so, will the change be beneficial or harmful? Some of the conservation practices which very likely influence insect populations (and for that matter, birds and mammals also) and which should be studied from this viewpoint are:

Strip cropping

Crop rotations

Cover crops in cultivated fields and orchards

Hedges

Field border plantings

Farm ponds (especially designed with respect to mosquito control)

Use of special erosion-control plants (e.g. kudzu with respect to white-fringed beetle)

Stubble-mulching (crop residue on stubble left on fields for erosion control, especially in semi-arid plains)

Sub-surface tillage (e.g. effect on grasshopper numbers)

Rodent Problems. The funds normally spent each year in the control of wild rodents believed to be harmful to the growth of crops, range vegetation, and forests, amount to several million dollars. Notwithstanding the considerable expenditure for rodent control, and many special studies on rodent life histories and habits, our knowledge of rodents as they relate to land use is far from adequate. Under what conditions is it both economically and biologically sound to reduce rodent numbers, and what land management recommendations should accompany such reduction to assure it a measure of permanence? One of the chief needs is a knowledge of the effect of livestock grazing upon rodent populations. We need to know more about the environmental effect of the reduction of a wild mammal species, especially in range areas, where not much is yet understood of the effect of rodent control upon range vegetation.

We still do not know enough about the results of standard poisoning methods, e.g. the percentage of the population of various rodent species destroyed, how long it takes survivors to build back to normal numbers, and how rapidly various species move into a poisoned area from outside. We need to know also the effects of rodents, e.g. kangaroo rats, pocket mice, ground squirrels, and prairie dogs, upon range reseeding. Their influence upon rangeland succession should be better known, and so should the relationship of rodents to climax types of vegetation. Numbers of rodents and their effect upon orchards managed with cover crops to control erosion should be further investigated. Finally, the influence of burrowing rodents upon erosion and infiltration of rainfall, and their effect upon soil condition are all too imperfectly understood, although what is already known indicates their value may be as great as that of earthworms.

Noxious Plant Problems. That weeds are often abundant as a result of land use is common knowledge, and much has been learned about how to control weeds, which cause damage to agriculture in excess of that caused by harmful insects. Weed control as a result of cultural practices has re-

ceived far less attention, however, than control by direct, aggressive means, such as burning, cutting, or use of chemical sprays. Yet good land management may be the most permanent and least costly kind of weed control. The effects of various recommended soil and water conservation measures upon weed species should be more thoroughly understood, especially the occurrence of weeds in crop fields, pastures, and range lands with reference to kind and intensity of use. To date the methods most widely employed for the control of mesquite, cedar, cactus, and many other noxious perennial plants, are aggressive ones. There is still considerable uncertainty concerning the extent to which the spread of such plants is due to past and present land use, and what types of land management should accompany their control if it is to be assured any reasonable degree of permanence.

Effects of Erosion on Plant and Animal Communities. Although the changes caused by erosion may at first seem obvious enough, resulting so often in denudation of land, such changes are not very well understood with respect to their effects upon plant and animal life. Even if erosion does not denude a habitat, it results in material environmental change. Sheet erosion alone causes a marked variation or destruction of upper horizons of soil profiles. It also changes soil fauna and flora and modifies the surface communities of plants and animals. But what is the nature of such changes, and how do they relate to land uses? We might well profit, in a very practical sense, by knowing more about the ecological behavior of living things, as it relates to accelerated soil erosion.

One of the great unknowns in this field is the effect of erosion upon water animals and aquatic habitats. There is reason to believe that sedimentation of streams, ponds, and lakes strongly modifies water environments, to the extent that useful aquatic life—fish, mussels, oysters, etc.—as well as general public use of water, is very seriously affected. Yet the studies on this subject are as yet very few.

The effects of man-induced soil erosion upon living communities, as well as the relationship of wild plants and animals to land-use practices employed to achieve soil and water conservation, form a subject of both academic and practical significance. Those who will undertake to study it can render a highly useful public service and at the same time contribute to fundamental knowledge in the field of applied ecology.

Added Income from Christmas Trees

Trimming the ends of Christmas trees after they are cut with an ax. This is a part of the harvesting job.

By ELMER C. LOY

The harvest of last season's Christmas trees brought some $553,000 to Flathead and Lincoln Counties in northwestern Montana where, although a specialty crop, it has become a major industry.

For some, it meant extra money for Christmas presents or war bonds; for others, it meant stretching farm income so that all expenses could be met. On the basis of the last census figure of 2,235 farms in the two counties, the average returns from Christmas trees was slightly under $250.

Just short of 2½ million Christmas trees were harvested in the two counties. These amounted to 503 carloads, of which all but a dozen were shipped by rail. The others were trucked to cities for sale.

A little over $385,000 went into payment to the producer for cutting and hauling. The producer paid his cutters, as well as stumpage prices to the owner if he cut on other than his own land, and either hauled the trees to the shipping point or hired it done. The remainder, nearly $165,000,

EDITOR'S NOTE.—The author is farm forester, Soil Conservation Service, Lincoln, Neb.

went to local labor for grading, tagging, bundling and loading.

Larger producers employed extra labor, but the smaller ones did their own work, receiving both the payment for the trees and the earnings for getting them to the shipping points. This averaged about 15½ cents per tree delivered to the cars. Other work at the shipping points cost the shipper about 6½ cents per tree.

The Christmas tree harvest does not compete with war activities. Coming at a time when field work on the farms is buttoned up, this harvest draws principally on farmers and women of the community for labor. The past season, women were employed for some of the cutting. The freight cars occupied would undoubtedly have been empty on the eastward journey, since in this section the heavy traffic is westbound.

Virtually all of the trees, except those trucked out by individuals to cities for sale, are contracted by some of the several firms active in the Pacific Northwest. During the harvest season they establish receiving yards at shipping points.

The largest share of the trees came from farms which are largely timber-covered, and many of whose operators have always depended on woods-work for part of their incomes. Many came from National forest lands, where they are cut according to specifications designed to leave the remaining trees freers to develop high-quality wood products.

By careful cutting, one tree can be made to furnish several Christmas trees. The hand here points to the place from which the first tree was cut a few years ago. At right are remains of the branch which grew into the second Christmas tree. At left is another branch which will develop into a Christmas tree in a few years.

In an effort to develop the Christmas tree industry as a permanent thing—part of the best use of privately-owned forest lands—the Soil Conservation Service has been assisting farmers in establishing a system of forest farming.

This assistance came through the farm forestry demonstration project at Kalispell, Mont., cooperation with private operators, and assistance to the Tobacco Valley Soil Conservation District's cooperators in northeastern Lincoln County.

How to select trees for cutting, how to thin stands for greater production of Christmas trees on a continuous basis, how to leave branches that will develop into Christmas trees, and how to grade and care for them, are some of the things demonstrated to the farmers, more of whom are adopting the improved practices each year with a view to sustained annual yields.

Although most widely known, the Christmas trees industry is only part of a farm forestry business which the technicians are helping the operators develop.

Northwestern Montana is predominantly a timber country, with the amount of farmland limited and many units insufficient in size to be supported by cultivated crops alone.

Most units, on the other hand, have enough timberland to make them self-sustaining if the timber resources are developed and handled properly. The products include fenceposts, poles, fuel wood and sawtimber, and, of course, Christmas trees. Growing and harvesting of these products also furnish winter employment.

The Soil Conservation Service and the soil conservation district to date have concentrated on helping farmers set up marketing groups and also on showing them how to clean up their stands for greater production of high-grade products. The demand for pulpwood during the war stimulated this process.

Christmas trees, however, have been in the forefront largely because the ready market was there in the form of contractors, and the trees represented a ready cash crop. To a large extent they were regarded as something extra from the land, and cutting was indiscriminate, except on the National forest lands.

Present developments have progressed to the point where a larger proportion of Christmas trees are cut according to recognized sustained-yield practices.

NATIONAL 4-H AWARDS IN SOIL CONSERVATION

Winners of $200 college scholarships in National 4-H Club Soil Conservation Contest. Top row, left to right: Samuel Burkhart, Jr. 18, Washington, Ind.; Alfred Neumann, 18, Bigfoot, Tex.; Ray H. Crosby, 18, Mohawk, Tenn.; Earl Brown, 20, Dwight, Kan.; John A. McGee, 15, Okemah, Okla. Bottom row, left to right: John L. Murphy, Jr., 20, Mt. Sterling, Ky.; H. Orell Haagenstad, 19, New England, N. D.; Robert Schwartau, 20, Goodhue, Minn.

By WALTER W. JOHN

For the first time in the history of 4-H clubwork, national awards for achievements in soil conservation were made at the 23rd National 4-H Club Congress, which met in Chicago December 3-6. Sixteen boys from as many states won free trips to the Congress, and 8 of them were given additional prizes of $200 college scholarships. The Extension Service and State Agricultural Colleges sponsored the Nation-wide soil conservation contest and all awards were provided by the Firestone Tire and Rubber Company.

Winners were Samuel Burkhart, Jr., Daviess County, Ind.; Earl Brown, Geary County, Kan.; John L. Murphy, Jr., Montgomery County, Ky.; Robert W. Schwartau, Goodhue County, Minn.; H. Orell Haagenstad, Slope County, N. D.; John Arlen McGee, Seminole County, Okla.; Ray Harry Crosby, Greene County, Tenn.; and Alfred Neumann, Frio County, Tex.

The other 8 state winners, who attended the Congress as the guests of Firestone were Willard L. Robinson, Jr., New Castle County, Del.; Clifford W. Holloway, Jr., Harford County, Md.; Alfred W. McKinstry, Hampden County, Mass.; Russell G. Mawby, Kent County, Mich.; Howard Calkins, Bernalillo County, N. M.; Wayne Stoutenburg, Union County, S. D.; Donald C. Jensen, Chippewa County, Wis.; and Lyle Wilson, Campbell County, Wyo.

In announcing the scholarship winners at the annual banquet, Jess Cune, who takes the part of Scattergood Baines in a well-known radio serial, referred to the soil conservation contest as "the newest and probably the most important of the 4-H Club projects because we recognize that the soil is the source of all our agricultural production." Russell Firestone personally presented the scholarships. Although there were no girls among the national winners, some were entered in the county and state contests.

Entries were submitted from 325 counties in 28 states. It is planned to repeat the contest next year, possibly with some revisions in suggested activities.

Significantly, 6 of the 8 scholarship winners live on farms in soil conservation districts, and most of them reported having worked out farm

EDITOR'S NOTE.—The author is head, regional section of education, Soil Conservation Service, Milwaukee, Wis.

plans with the district supervisors and Soil Conservation technicians. Some even helped organize districts. Eighteen-year-old Alfred Neumann reported that he and his brother presented a soil and water conservation demonstration for farmers at every schoolhouse in that part of his county which was being considered for a district. And he added, "that part of the district was organized without a dissenting vote."

The influence of son on father in obtaining application of soil conservation practices was also apparent. Concerning the report submitted by Robert Schwartau of Minnesota, County Agent G. J. Kunau wrote, "Through his interest in soil conservation, has influenced his father to develop a complete foreign conservation plan in cooperation with the East Goodhue Soil Conservation District."

John L. Murphy, Jr., the Kentucky boy, said, "I think I have sold my father on contour rows because he plans to buy a farm level."

Wakelin McNeel, state 4-H Club leader in Wisconsin, and popularly known as "Ranger Mac," described the soil conservation contest as a "culmination of the great interest in this subject and an award to a few who have done the best work with their projects. The award is not the important thing, though," he pointed out. "The greatest value in these projects is the development in youth of a proper attitude toward soil and the experience that 4-H Club boys and girls obtain in conservation."

One of the outstanding records of accomplishments in the contest is that of Earl Brown of Geary County, Kan. Here is the list of soil conservation projects he completed in the last three years on his father's 267-acre farm and 182 other acres they operate:

1. Built 6 miles of terraces (3 by grader and 3 by plow).
2. Made an outlet channel and sodded it.
3. Maintained terraces by backfurrowing them each year.
4. Farmed all terraced land on the contour.
5. Had an activated booth at the Kansas State Fair showing how to build terraces with a plow.
6. Made a diversion ditch.
7. Built a 2-acre pond and stocked it with fish.
8. Provided food and cover for wildlife.
9. Planted 149 acres of clover and 97 acres of alfalfa.
10. Fenced 19½ acres of woodland.
11. Hauled all manure out on the land.
12. Used phosphate on wheat and alfalfa.
13. Clipped weeds on permanent pasture.
14. Talked on soil conservation at local club meetings.

"Our plow terraces were among the first in Geary County and in Kansas," Earl said. "L. A. Jacobson, soil conservationist, brought dozens of farmers to see them. All liked the terraces and found it easy to understand how to build them. Building terraces with a plow is now the accepted method among our farmers on fields where the slope is not more than 5 percent."

Earl suggested that his county have a plow terrace exhibit at the state fair, so the county agent gave him the job of building and tending it.

Samuel Burkhart, Jr., has worked out a complete soil conservation program for the 160-acre farm his father purchased in Daviess County, Ind., two years ago. With the guidance of district supervisors and District Conservationist Ward Studor, he has built nearly a mile of terraces, laid out contour lines, rearranged fences to facilitate contouring, built a stock pond, and opened up drainage ditches.

"Our ultimate goal," Sam reported, "is to have all fields limed, fertilizer applied in the right amounts, all fields growing good legumes, a good crop rotation established, all fields cultivated correctly (on the contour), all terraces completed, the farm completely fenced, a good supply of pasture, a woodland for posts, and a farm stock pond."

Sam established himself as a soil conservation salesman at a Friends of the Land meeting in Chicago November 27. Speaking the language of a true son of the soil, the red-haired Indiana boy convinced the 150 leading industrialists and professional men and women attending the meeting that conservation farming is a "must." He told them how that farming should be done, too.

Ray H. Crosby made his own farm level and used it to lay out contour lines on his father's 218-acre general livestock farm in Greene County, Tenn. He carefully analyzed the fertility needs of their soil and is following a systematic program of fertilization. Seeding waterways, planting cover crops, protecting the woodlot against fire and grazing, and building gully dams are parts of his project to control erosion on the home farm.

Orell Haagenstadt of Slope County, N. D., concentrated on measures to check wind erosion on the 1,500 acres of farm and range land he and his father own. Soil Conservationists Bahr and Dietrich guided him in working out plans for strip cropping, tree shelterbelt, adapted grasses, and wildlife plantings.

Here is one means of interesting city dwellers in the new ways of farming. These murals are in the office of Kenneth E. Shepard, a Chicago advertising man. He borrowed the negatives from the Soil Conservation Service, had the views expertly enlarged and mounted on the walls, with the idea of pleasing his customers and teaching them something of soil conservation.

Youngest of the scholarship winners is John Arlen McGee, 15, Seminole County, Okla. He developed his soil conservation project around their livestock farming program. During his few years of 4-H activities, he has completed 29 livestock projects. He and his teammate won the Oklahoma 4-H demonstration championship this year with their discussion and display of soil conservation practices on a model farm.

An enthusiast for farm ponds, John had this to say for them, "A pasture is not very efficient if it does not contain a pond of some kind. If more attention were given to American farms in control of erosion and to the healthfulness of livestock, more farm ponds would be built."

Kentucky's winner in the national contest, John L. Murphy, Jr., of Montgomery County, started in his community the new practices of contour farming and seeding cover crops on tobacco land to increase production. "They kept the fields from washing away in spring and held moisture during the drought," he said. Balbo rye and vetch were the cover crops he used. He laid out the contour rows himself and built a pond dam with a bulldozer.

Alfred Neumann and his brother have been in complete charge of the family's 170-acre farm in Frio County, Tex., since their father died two years ago. They also have been farming another 100 acres to help boost food production. Their farm conservation plan, developed in cooperation with County Agent N. H. Hunt and the local soil conservation district, includes contouring, terracing, grassed waterways, rotation and deferred grazing, and a pond. They lay out their own contour and terrace lines.

The demonstration that the Neumann brothers gave in schoolhouse meetings for organization of a district had this bit of masterful presentation, "Did you ever dream of building a 'little nest somewhere in the west,' and would that nest in the west be a gully-washed, eroded hillside? Or would contoured rows and the symmetry of terraces, and growing grasses and ripening grains be your dream?"

The top winner as far as number of projects is concerned is Robert Schwartan, Goodhue County, Minn., who influenced his father to "sign up" with the soil conservation district. Robert has completed 37 projects during his 4-H career, Most of them were livestock projects, which included lambs, pigs, heifers, turkeys, and a colt. During the three years that he has been practicing soil conservation he has followed a program of contour farming, building terraces (with a plow), establishing grassed waterways, filling gullies, and improving conditions for wildlife.

One of his future projects is to eliminate the cattle lane on his father's farm. "It's a sore spot," he said. "I haul dirt back up the lane every year so we can haul crops and machinery over it." He and his father decided the highway ditch along their farm should be vegetated so they planted alfalfa and timothy on it. Their harvest from that ditch is about three loads of hay per crop.

In concluding his report to the national committee, Robert wrote, "I work with the soil almost every day in some way and, if that isn't enough to make one stop and think about all our erosion, I would like to know what is. After all, where do we make a living from on the farm, if it isn't from the soil?"

THE GREATER TASK AHEAD

By R. W. ROGERS

There is yet confronting us the tremendous task of *total* conservation. Too few people realize that the present rates of soil and water losses far exceed the annual savings brought about by established conservation practices and measures.

Considering all of the 6,096,799 farms and ranches, those practicing conservation farming as well as those not doing this kind of farming, the average annual yield per acre for 17 principal crops has increased an average of 15.2 percent per year since 1937, as compared with the 10-year average annual yield of the same crops for the period 1923 to 1932. Established conservation practices and measures, improved seed varieties, fertilizers, patriotic efforts of farmers and ranchers and other things such as generally favorable weather, have helped to bring this about. But notwithstanding our total improvements on the land there is still an average annual loss in yield per acre of about 1 percent per year for all crops during the last decade. Much of our best soil—that thin precious layer of productive topsoil—is continuing to wash downstream.

In 1944, erosion-inducing and soil-depleting crops such as corn, small grains, potatoes, etc., were harvested from approximately 40 million more acres than in 1940. Obviously, the conservation job must be intensified.

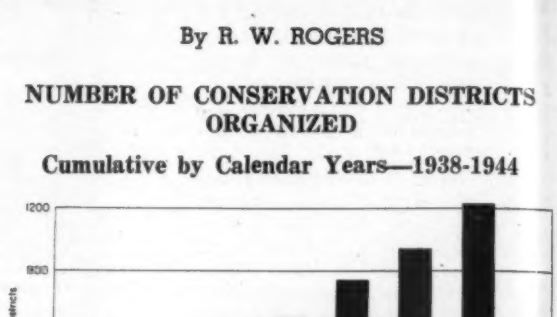
Many farmers and ranchers in 45 States have already taken the necessary steps to set up local democratic organizations to administer and coordinate the conservation job on the land. With trained leadership and technical guidance, the practices needed to control erosion and improve fertility on over a billion acres of farmland can be carried out by landowners and operators themselves.

On December 15,1944, there were 1,203 organized soil conservation districts comprising a total of 668,563,948 acres and 18 grass conservation districts containing 6,613,136 acres. There were 3,109,536 farms and ranches in these districts. The Soil Conservation Service was working with 1,087 district governing bodies.

At the present time, the Soil Conservation Service's share of the total conservation job on private lands divides into three main categories, namely: (1) planning of farms and ranches for conservation; (2) assistance in the establishment of conservation practices; and (3) guidance in maintenance of established practices and measures. There are also the programs of widespread application of simple practices, like contouring, rotations and controlled grazing, on farms not having plans; group enterprises, such as drainage; irrigation and flood control, involving many farms or an entire watershed; land management, on Federal lands administered by the Service; and research, to develop improved techniques.

NUMBER OF CONSERVATION DISTRICTS ORGANIZED

Cumulative by Calendar Years—1938-1944



During 1943, in districts, a total of 54,174 new farm and ranch conservation plans containing 17,629,318 acres were prepared by Soil Conservation Service technicians in cooperation with owners and operators, and 9,805,538 acres were treated. For 1944, it is expected that about 58,000 plans containing 18,900,000 acres will be prepared and at least 12,500,000 acres will be treated. By the end of 1944, a total of 259,501 plans in districts will have been prepared in which the owners and operators agree to go ahead with desirable land use and necessary treatment on 73,205,342 acres, and approximately 37,703,833 acres will have had the planned practices established. With the present trends in district organization and increased demands for conservation, it appears that by 1950 provisions should be made on a nation-wide basis for a conservation planning load nearly double that of 1943, and an establishment load at least three times as large.

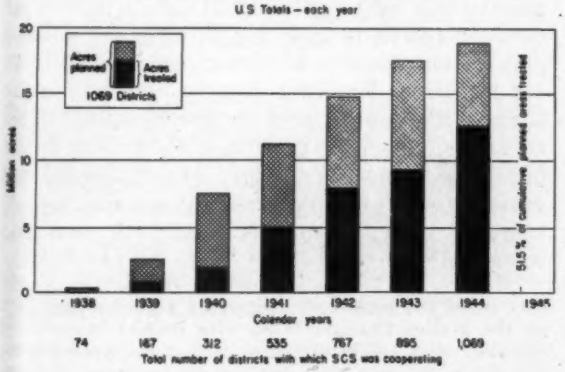
There are many factors which affect the rates of establishment of conservation on the land and the quality of the work. In some localities, the

EDITOR'S NOTE.—The author is chief, records and reports division, Soil Conservation Service, Washington, D. C.

rates and kind of accomplishments are affected by the attitude of local landowners and operators, their customs or habits, their degree of recognition of erosion conditions, and the like. However, after the decisions to go ahead have been made, it is the difficulty or complexity of the conservation job and the methods or techniques used that determine the amounts of work accomplished. Conditions vary, even by communities and farms; therefore, varying procedures must be used. Each segment of the task should be examined in detail, in itself and in its relation to the whole, and determinations made as to the correct procedures.

Intensification of the conservation job is a challenge to the intelligence and industry of all concerned. Farmers and ranchers should fully accept their individual responsibilities. Group action in many cases is imperative. These are necessary before conservation can be established and maintained on a substantial acreage. District governing bodies will do well to strengthen their leadership, utilizing community and neighborhood leaders wherever possible. State committees (boards or commissions) may wish to advise districts more fully with respect to priority of areas, coordination of activities, use of funds, and other available

ACRES PLANNED AND ACRES TREATED
Soil Conservation Districts



facilities. Urban folk and civic organizations having an interest in the land can be of help. Industrial manufacturers, processors, and equipment companies directly and indirectly dependent on the products of the soil, can provide equipment, material, and supplies. County, State, and Federal agencies, assisting landowners and operators through districts, can improve or in some instances increase their assistance to districts. Improved procedures and techniques should be invoked to get on more rapidly with the conservation job.

Nothwithstanding American agriculture's heroic response to the war need for increased production —a response that will continue so long as the emergency exists, the fact remains that the total soil conservation job is but well begun. To insure a *permanently* productive agriculture more strenuous efforts must be exerted and the work on the land must be greatly intensified.

ACCOUNT OF STEWARDSHIP

Reporting the progress of the Washakie Soil Conservation District in central Wyoming is no mere formality with the board of supervisors. Instead, the district board of supervisors teamed up with the Farm Bureau, which sponsored organization of the district, to give a public oyster supper and dance. The soil conservation district's progress report was made to that assembly.

Frank Dunn, chairman of the board of supervisors, was spokesman. He described the work accomplished, the new lands brought into production, the savings to farmers through use of contract equipment, the value of soil surveys, better irrigation, crop and soil management, and other work with which the district and assisting Soil Conservation Service technicians help the farmers.

Dunn also discussed opportunities for further work, mentioned 4,000 acres of land under existing canals and on which water assessments are paid but which produce nothing. This is the equivalent of 20 new farms of 200 acres each. The technical help needed to reorganize irrigation systems for better farming and higher production, and the possibilities for pump irrigation of 14,000 acres above the canals came in for discussion.

He made quite a point of the fact that the work of the district and of the Soil Conservation Service in the district is governed entirely by the farmers themselves—"the only set-up" he said, "so governed without restrictions and qualifications."

Nearly 300 people attended. Their interest was aroused by a display of pictures of district work and a demonstration model of spile irrigation. The district's share of the cost of the meeting was $75.

—A. E. McCLYMONDS.

In the tidewater soil conservation districts the Virginia Commission of Game and Inland Fisheries, working with the Soil Conservation Service, is testing land-management measures in marshlands to improve conditions for muskrats.

REED CANARY PAYS OFF ON MICHIGAN MUCKLAND

The same 4-acre field of reed canary grass carried 25 cows all last summer. Field at right had unpalatable marsh grass.

By W. L. WILLIAMS

More pasture, more hay, more seed, and even more muskrats have resulted from growing reed canary grass on muckland in the Fenton Soil Conservation District, Livingston County, Mich. On wet muck areas that cannot be drained economically (which includes nearly 8 percent of the Fenton District) reed canary grass is proving quite profitable, where before only the poor-quality marsh sedges would grow.

Lloyd Salmon, a farmer cooperating with the Fenton Soil Conservation District, says, "Before I had reed canary grass I used to rent additional pasture each summer, but now I have all I want and have extra pasture I could rent to my neighbors."

Two other district cooperators, Burton and Manfred Harris, put up 70 bales an acre from their ungrazed reed canary grass and sold it at 75 cents a bale. Walter Pazinski harvested more than 1,000 pounds of clean seed from his 5-acre planting. The increase in muskrat population was reported by Elroy Warner who attributed it to the fact that reed canary grass shoots and roots provide more and better feed than native grasses.

About 500 acres of marshy land have been planted to reed canary grass since it was introduced in the erosion control demonstration project there in 1938. It proved to be just the forage crop needed to supplement native bluegrass and alfalfa pastures during the late summer. A hundred farmers in this dairy section that helps supply the Detroit fluid milk market have benefited from this new summer pasture during dry periods when other grasses are at low production.

When the Fenton Soil Conservation District was organized in 1940, the directors secured a crawler-type tractor and a 22-inch marsh plow to help prepare a good seedbed for reed canary grass plantings on marsh land. This equipment was a boon to the entire program of the district because farmers were willing to try some unfamiliar soil-saving practices such as contouring, strip cropping, and terracing in order to have their marshland plowed. Thus, the whole farm was put to better use under a soil conservation plan.

Many of these marshy areas were landlocked and under water much of the year and could be plowed only when the water table became lowered in middle or late summer. Since reed canary grass thrives under wet soil conditions, it is ideally suited for such areas. Its tough, well-matted turf holds up considerable weight of grazing animals or equipment for harvesting seed or hay.

The cost of establishing reed canary grass on marshlands varies between $15.50 to $18.00 an acre—including $8 to $9 for plowing and seedbed preparation, $2.50 to $3.00 for seed, and $5 to $6 for fertilizer. Figuring that an acre will graze three or four animal units for five months at $1.00 an animal-month, an income of $15 to $20 in the first year would pay the cost of establishing the grass. A stand of reed canary grass may last 20 years or more; it spreads from both seed and rootstock.

Harvesting 200 pounds of reed canary grass seed per acre on the Walter Pazinski farm, with crawler tractor and combine. Note height of grass. It was not grazed prior to cutting.

EDITOR'S NOTE.—The author is farm planner, Soil Conservation Service, Fenton, Mich. *Soil Conservation* would be interested in the experiences of other regions with regard to ladino and other clovers in comparison with reed canary grass, and in having suggestions as to the grazing management of reed canary grass.

Most of the seedings have been made before September 1 because a few made in September and October were unsuccessful. The recommended rate is 6 to 8 pounds an acre with 200 to 300 pounds of fertilizer of 3-19-18 or comparable analysis. Seeding shallow and cultipacking are recommended.

Reed canary grass will stand heavy grazing. As an example, 30 head of livestock grazed 6 acres of it all last summer on the Charles Sutton farm, and there was plenty of feed left. Where the number of livestock is not sufficient to keep it down to 6 or 8 inches high, it is advisable to clip and remove a crop of hay.

Newly seeded reed canary grass pasture, at left, on farm of Lloyd Salmon. Before it was plowed in 1939 this area was similar to marsh grass field at right.

REVIEWS

THE NATURE AND PROPERTIES OF SOILS. By T. Lyttleton Lyon and Harry O. Buckman. The Macmillan Company, New York. 1943.

Professional soil conservationists every day run into practical questions about soils. They can find some, but not all the answers in the new Lyon and Buckman text. The fourth edition (1943) is the work of Doctor Buckman and has been dedicated to the memory of his distinguished colleague.

The book is a standard college text, clearly written, thorough, and although rather severe no more so than most elementary texts in technological subjects. Therefore the authors presuppose a knowledge of freshman college chemistry and the equivalent of high-school physics, as they must in a book intended chiefly for second-year college students. The reader whose acquaintance with school or college sciences took place more than two or three years ago will find the going a bit rough in some parts, especially in chapters IV, VII and XIII, but the reward in understanding is well worth the effort.

The opening page is an excellent statement of fundamental viewpoints. The reader is invited into the wide field of edaphology which is soil and its relations to higher plants, rather than the more narrow confines of description and classification that make up pedology. When we accept the invitation we find that the discussions of principles and processes are mostly adequate for a beginner's approach through either viewpoint, and that the edaphological applications are clear as far as they go.

Organization of the material is for the most part good. Following the opening chapter on the soil in perspective, there are seven chapters primarily about the physics, chemistry and biology of soil materials and two chapters on soil moisture control. Then there are two chapters about soil formation and classification, two chapters about soil reaction and liming separated by one dealing with organic soils, and four final chapters that deal with nitrogen economy, fertilizers, manures, and fertility management of mineral soils. Naturally, no one arrangement can be ideal either for teaching or for the practicing technician who uses the book to brush up his knowledge of soils. It would appear that something might be gained by treating soil reaction more closely with other phases of the chemistry and physics of soil materials, and transferring the two chapters on water control, which include erosion control, to a position closer to those that deal with other aspects of soil management. Soil management and soil erosion control are essential parts of soil conservation farming and it is seldom, if ever, that one can be achieved fully without the other, or without water control and economy.

Deficiencies in the present text are decidedly the reflection of still undeveloped areas of soil science and technology rather than of Doctor Buckman's oversight or neglect. Some edaphological interpretations urgently needed by every soil technician, but not available now in any book, involve the practical significance for plant growth of the soil characteristics that can be identified by sight or feel and by simple tests such as the color test for soil reaction. Our soil technicians are gradually learning the significance, in crop responses, management needs, and erosion potentialities, of depth of the root zone, texture of the surface soil and properties that affect water movement in and below the root zone. As soon as the edaphological applications have been worked out in enough localities, a summary of the principles will be a welcome addition to textbooks on soils.

The book is an excellent exposition of the accumulated findings of laboratory and field-plot investigations, supported by enough and not too much quoted data to illustrate the principles that are involved. It contains a few references to field observations on the properties of different soils, although they are interpreted mostly for their pedological rather than their edaphological significance. This treatment leaves the college graduate, even if he has had a second course in soil fertility and management, at the best only partly prepared to see, interpret and use soil facts as he uncovers the subsoil and deeper layers with auger or spade. Practicing soil technicians will always have to learn much from Nature's textbooks. If they will set down in writing some of the things they learn, writers of more formal textbooks will be able to improve each new edition and help train young technicians to understand soil science and put it to work.

—J. Gordon Steele.

SOME ECOLOGICAL ASPECTS OF AFFORESTATION AND FORESTRY IN GREAT BRITAIN. By Sir Roy Robinson in Forestry, The journal of the Society of Foresters of Great Britain, Vol. XVI-1942.

The author reports on the results of many forestry experiments, mostly in tree planting in Great Britain, some dating from 1883, others from 1900 and 1909. His main thesis is that ecological succession can be greatly accelerated by planting appropriate combinations of "pioneer" and "successor" species. He described the principal planting site—"the bulk of the land which is available for afforestation has been grazed or periodically burned for long periods of time and in those processes has been greatly reduced in fertility, sometimes practically to bedrock. A good account of the effect of long-continued heather burning and grazing upon the moorland vegetation of the west of Scotland is given by Fraser. Perhaps the most striking change brought about by inclosure and cessation of burning in hill country is the great development of heather (Calluna vulgaris). Often the heather to begin with is so inconspicuous that it passes unnoticed, but land which was apparently green and grassy may quickly assume the appearance of a heather moor. It is such areas as well as those which originally were easily recognizable as heather moors which have given so much trouble in afforestation."

On the heather sites, pine (several species) are the pioneer trees and spruce and Douglas firs are the successors. Where pine and spruce are planted simultaneously, spruce immediately goes into check—in other words, it completely stagnates but continues to live. The pine immediately begins to grow. The emergence of the spruce from check corresponds with the development of the pine.

The first signs are the greening and the lengthening of the needles which usually happen about the eighth year when the pines are about 8 feet tall; the spruce trees at that time are very small. Next, the annual "leading shoots" increase in length and by the 12th or 14th year approach normal growth. After this the spruce may require more light, which is accomplished either by completely removing some of the pines or by pruning them. Where spruce or Douglas fir were planted alone, the condition of complete check already referred to continues indefinitely. The author shows pictures where the spruce adjacent to pine plantations responds to the latter's influence by growing normally, whereas, all of the rest of the spruce (not influenced by the pine) continues in check. He reports similar experiments on chalk sites which are basic in reaction while the heather sites are acid. On these soils spruce may sometimes be the pioneer species which develops the site to the point where such species as ash and beech will grow. (Note: Incidentally, Mr. McIntyre and I saw the same relationship between pine and hard maple on a 10-year old planting at State College, Pa., last summer. Where hard maple was planted alone it made exceedingly unsatisfactory growth, but where it was mixed with pine, both the pine and maple were making excellent growth).

All of this the author calls accelerated succession, and this is his hypothesis: "In the natural afforestation of difficult sites some species are pioneers and some are successors. It is not feasible by artificial means to bring in the successors in advance of the pioneers. It is possible, however, to accelerate the natural succession by mixed planting of pioneers and successors and by appropriate thinning treatment to complete the succession in the course of a single rotation. A successor on one site may be a pioneer on another."

A second hypothesis he calls the silvicultural stream: "In the silvicultural treatment of woodlands the most effective methods are does which proceed in the direction of a natural succession of vegetation." This is simply carrying the ecological concept from the plantations to forest management which he refers to as "a great stream moving slowly but relentlessly in a set direction. To move with it is easy, but to move against it is a constant effort with a certain risk of return to the starting point if the effort is relaxed." This is the familiar theory of the development of the climax forest type, and it is very excellently presented in the Harvard Forest Bulletin 21—1942, "Virgin Upland Forest of Central New England," by A. C. Cline and S. H. Spur.

By way of illustration of his theory of the silvicultural stream, the author cites the example of trying to underplant, with a new species, a recently cut-over coppice woods. The transformation is accomplished only by repeated cutting back of sprouts, and even then the site suffers in the process. He contrasts this undertaking with the more natural one of waiting until the coppice trees have about reached their maturity, when the canopy begins to break. At this time, success with under-planting is easily obtained, if the overhead coppice is killed gradually by "ringing" and in so doing there is little or no deterioration of the site.

The author frankly admits that he is not able to explain why the pioneer species effect such a remarkable change in the site which enable the successor species to grow. He mentions a theory about opening up and aeration of the soil but, he says, the same effect can be obtained by deep plowing. The change in the site effected by the pioneer species was probably due to intricate natural processes involving fungi, mycorrniza, earthworms, and microorganisms. "The whole ecology of the site is modified, and in some way or other this change is connected with increased vigor of growth of the trees."

—JOHN F. PRESTON.

"CINCHING UP"

(*Continued from page* 190)

There are 134 million acres of range and pasture lands in the Northern Great Plains, with about half that area in soil conservation districts and land utilization projects. More conservation districts are being organized by the farmers and ranchers in order to get technical help in developing good methods of range management. Virtually all realize that the time to put ones house in order is in favorable periods.

Conservation technicians, experiment stations, and extension services have a bigger job than ever —and a lot more satisfying one than in the days when drought laid a heavy hand upon the unprepared livestock industry. It is always better to prevent troubles than to have to undertake emergency measures to counter disaster after it strikes.

WATER CONSERVATION

This clear pool is on the farm of Mr. and Mrs. House, a mile and a half west of Concrete, in Washington's coastal Skagit County.

The fish pond is but just one unit in a conservation program developed through the Skagit Soil Conservation District. It is stocked with cut-throat trout now ranging from 8 to 15 inches in size. Some day, House plans to build a larger pool.

Water that provides the fish with a constantly cool, fresh supply is piped from the hills above the 80-acre farm. With a nearly 100 foot fall in the water line, it also runs a turbine for electric lighting and refrigeration, including a frozen food locker, and supplies domestic and stock water. The water then is piped on down into the level alfalfa meadows seen in the background and used during the dry summer months in a sprinkler irrigation plant purchased and installed with soil conservation district assistance.

Both Mr. and Mrs. House were active in organization of the Skagit district.

REFERENCE LIST ☆☆

Compiled by William L. Robey, Printing and Distribution Unit

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